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PNEUMONIA

IN

YOUNG CHILDREN.

BY

L. EMMETT HOLT, A.M., M.D.,

ATTENDING PHYSICIAN TO THE CHILDREN'S DEPARTMENT OF THE NORTHWESTERN
DISPENSARY ; INSTRUCTOR IN THE NEW YORK POLYCLINIC.

*Read at the Section of Obstetrics and Diseases of Children, New
York Academy of Medicine.*

Reprinted from THE MEDICAL RECORD, February 14, 1885.

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PNEUMONIA IN YOUNG CHILDREN.¹

A COMPLETE description of a disease like pneumonia, even if we limit it to early life, is not possible within the limits of a paper like this. I shall confine myself mainly to the clinical features of the disease, as deduced from a comparative study of eighty-six cases, which I have had under personal observation and whose histories have been carefully recorded.

As these cases are taken indiscriminately from private and dispensary practice they can be assumed fairly to represent the disease as it is seen outside of large institutions for children. As my object is not to establish the value of any particular line of treatment, the cases have been taken consecutively, and include all those I have seen during the period covered, at whatever stage and for howsoever long a time under observation.

I much prefer and shall use the terms lobar and broncho-pneumonia, instead of croupous and catarrhal, or lobular, to designate the two varieties. The latter terms though fairly descriptive are rather misleading than other wise.

While broncho-pneumonia is the form essentially peculiar to early life, the lobar variety occurs often enough to demand a portion of our consideration.

Some idea of their relative frequency may be gained from the fact that of seventy-four cases under five years, eighteen were lobar and fifty-six cases of broncho-pneumonia, or about one to three. Baginsky, from a much larger

¹ Read before the Section of Obstetrics and Diseases of Children, New York Academy of Medicine, January 22, 1885.

number of cases, finds the same proportion. It is a mistake, then, to say that lobar pneumonia is rare under five years.

As it occurs in young children it presents the same general features as in the adult. We note its prevalence during the months of March, April, and May, its sudden invasion, its typical course, and its rapid defervescence on the sixth to the tenth day. Yet there are certain peculiarities, owing to the absence of some of the diagnostic symptoms present in adults, and the existence of certain new ones dependent on the conditions of childhood, which render the diagnosis difficult, and may cause it to be overlooked altogether without a careful physical examination. The following may be taken as an illustration of a simple uncomplicated case of average severity.

A well-nourished female child, aged ten months, after an exposure in the afternoon was taken in the evening of March 15th with vomiting, high fever, great restlessness, and cough. She was seen March 17th, with temperature, $103\frac{1}{2}^{\circ}$; respiration, 68; pulse, 170. Face was flushed; there was a good deal of general prostration. A patch of consolidation was found at the inferior angle of the left scapula. Signs: Marked dulness, bronchial breathing, no râles; signs elsewhere normal in both lungs. The next day the signs of consolidation had extended over the whole left lung except the extreme apex. The fever continued high until the 19th, when a marked decline took place, and after the 20th (sixth day) the temperature was normal. In a week's time almost complete resolution had taken place.

The disease is usually primary, and occurs more frequently in stout, robust children; males a little more often than females. A distinct prodromal stage is rarely present. The disease begins suddenly; it is ushered in most frequently with repeated attacks of vomiting. This was the mode of onset in about half my cases. Next to this, convulsions seem to be the most common. A distinct chill in a young child I do not remember to have seen in a commencing pneumonia. After six or seven

years it is more frequent. High fever sets in almost at once. The temperature rises to 104° , or even higher, the respiration to 50, 60, or 80 a minute, and the pulse to 120 or 160. There is great thirst. If still at the breast, the child desires to nurse almost incessantly. It seizes the nipple eagerly, pulls violently a few times, drops it for a moment, takes a few deep, quick respirations, and then catches it again. When not nursing the respiration is peculiar. There is a short, quick inspiration, a moment of suspension, and a forcible expiration with a slight moan or grunt. The expiration is accentuated, and is an active, rather than a passive, movement, as it seems to be in health. The cry, like the breathing, is short, quick, and interrupted. The cough partakes somewhat of the same character; it is teasing, hacking, persistent, and always dry. There is great restlessness and irritability, and occasionally the child complains of distinct thoracic pains. There is marked general prostration, the cheeks are occasionally flushed, but more often not, and the face is then pale and the expression apathetic. The temperature fluctuates slightly during the day, being 102° to 103° in the morning, and 104° to 105° in the evening, until the sixth or seventh day, sometimes not until the tenth, when it suddenly falls to or near the normal, and convalescence is rapidly declared. The crisis often comes with a copious diaphoresis. Although very ill as these children appear, and in fact really are, the mortality is very small. In twenty-five cases I have had but one death. The case was as follows:

A boy, aged nineteen months, rather delicate, was taken, on the evening of February 6th, with convulsions. He had lain in a drowsy, semi-stupid condition up to the time I saw him, February 8th, with a continuous high fever. There had been frequent vomiting. The temperature was $104\frac{3}{4}^{\circ}$; respiration, 50; pulse, 195. Respirations were a little irregular. There was no paralysis, the abdomen was natural, the pupils normal, a few coarse râles only in the lungs, and very little cough.

The next day the signs of consolidation were found in the left lower lobe posteriorly. Temperature, $104\frac{1}{2}^{\circ}$. On the following day—the fifth of the disease—the temperature was nearly 105° all day; once, at noon, touching $106\frac{1}{2}^{\circ}$. Still he seemed to be holding his own. On the sixth day the nervous symptoms became still more severe; he had screaming fits during the night, was excessively irritable, boring his head in the pillow. There was, however, no true stupor, he recognized the mother, and at times was bright. His respirations were not specially quick, 56 being the highest; there was no dyspnoea, and no cyanosis. His pulse was feeble, and rose in the evening to 200 a minute, and the temperature to $106\frac{3}{4}^{\circ}$. The signs of pulmonary oedema were then present, and he died from this cause five hours later. Throughout the course of the disease the general symptoms were very severe, and apparently out of proportion to the extent of lung involved, which was only half of the left lung posteriorly. This case corresponds pretty accurately with a form described by some writers under the head of typhoid pneumonia. Unfortunately no autopsy could be obtained.

The cerebral symptoms are often so prominent as to mask completely the rational symptoms of the pneumonia. The initial convulsions may be succeeded by an active delirium, general hyperæsthesia, vomiting and constipation, or by drowsiness verging on a true stupor, with slight opisthotonus and retraction of the abdomen. The cough is often absent in such cases, and the rapid breathing may be the only symptom to call attention to the lungs. A positive diagnosis is only reached by the physical signs. These cerebral symptoms may disappear after two or three days, or may last until the crisis, when they vanish with the fall in the temperature and the beginning of resolution, as in the following case.

A delicate little girl, two years of age, was seen on the fifth day of a pneumonia complicating whooping-cough. There had been constipation, vomiting, extreme irritabil-

ity, great prostration, loss of flesh, and complete anorexia. The temperature was $103\frac{1}{2}^{\circ}$, and the respiration 60. A patch of consolidation was found in the right lung anteriorly. For the three days succeeding, she presented the following symptoms: Great drowsiness, this being disturbed only by the cough, opisthotonus with rigidity of the muscles of the neck, retraction of the abdomen, the pupils responded sluggishly, the urine was scanty, the bowels constipated, the tongue dry.

This combination of typhoid and cerebral symptoms were the grounds of a grave prognosis, which was given. Yet with the occurrence of the crisis on the eighth day they all disappeared, resolution took place quite promptly, and the case made a good recovery.

Gastro-intestinal symptoms at the outset may be so severe as to engross the whole attention of the physician, and it may be several days before any pulmonary disease is suspected, as in the following case, where the pneumonia was only discovered by accident:

A stout boy, seven years of age, was taken on December 13th with severe vomiting and purging, and pain in the left hypochondriac region. I saw him at the dispensary on the 15th. He did not seem very sick, and had not been confined to bed. His tongue was heavily coated. The vomiting had ceased, but he was having from six to eight diarrhoeal passages a day. Nothing was disclosed by the rather superficial examination made, and an astringent diarrhoeal mixture was ordered. Two days later he was brought back by the mother, looking so sick that his case was more carefully investigated. His diarrhoea had not been in the least relieved by the prescription. He had had four passages that morning. The history of a high fever the night before, followed by a profuse sweat, led me to examine his spleen with a view to some possible malarial complication. Finding no enlargement, I casually listened to his lungs, and was greatly surprised to find all the signs of consolidation at the left apex. His temperature was $102\frac{3}{4}^{\circ}$, respiration 48, pulse 120. I

ordered him to be kept in bed, and I saw him daily at the house. The diarrhœa ceased the next day, practically without treatment. The disease ran thereafter a typical but somewhat severe course, the temperature being continuously high until the night of the eighth day, when it fell to normal with a profuse sweat. Quick resolution took place.

Regarding the *seat of the disease*, lobar pneumonia in children presents quite a marked contrast with what is found in adults. My own cases are too few to give any statistics of value upon the relative frequency with which the different parts of the lung are involved. They accord, however, with those given by Rilliet and Barthez and Baginsky, that the order of frequency is, first, the right apex; second, the left apex; third, the left base; fourth, the right base. Of 408 cases from the first authors, 170 were at the right apex. Of 50 cases from the last author, in 26 the right apex was involved, though not exclusively in all.

Physical signs.—Generally speaking, these do not differ essentially from those in the adult. The fremitus of the cry is usually increased; dulness is as a rule quite marked, though if the consolidated area be small, we may get exaggerated resonance over the whole chest. The subcrepitant râle, is, I think, more frequent than the crepitant; in fact, the latter I have rarely heard. The resonance of the cry is prolonged and intensified, the breathing is broncho-vesicular, and then bronchial. Usually pleuritic friction-sounds are heard.

The frequency with which the apex is involved should be borne in mind, and the region high in the axilla carefully examined, as it is here perhaps that the disease is most often overlooked. It is not infrequently the first, and may be only place, in which bronchial breathing is heard.

This frequency is also, perhaps, an explanation why pneumonia with cerebral or typhoid symptoms, and also central pneumonia, are comparatively so frequent in early life.

Before leaving the subject of physical examination, I wish to say a word about the use of the stethoscope. It is extremely difficult, well-nigh impossible in an infant, to examine the supra- and infra-clavicular and the high axillary regions satisfactorily and thoroughly with the naked ear. And these are just the parts we wish to be particular about. It can be done with great ease by the stethoscope. Children are less likely to be frightened into crying by the instrument, than by the head of the physician. In children of two or three years old this objection may not have the same force.

Diagnosis.—Although in most cases this is easy, it presents in some very great difficulty during the first two or three days before positive signs of consolidation appear. In central pneumonia this difficulty is greatly enhanced. In one case, in a boy of two years of age, there were absolutely no physical signs until the seventh day. Yet the rational symptoms, particularly the continuous high temperature, it being 105° and over, left very little doubt in regard to the diagnosis. The chest was carefully examined every day. The consolidation finally appeared at the extreme right apex.

Practically I have found lobar pneumonia difficult to distinguish from scarlet fever, typhoid, meningitis, tonsillitis, malarial fever, pulmonary congestion, and broncho-pneumonia.

The invasion of pneumonia and scarlet fever are very similar. We must wait for the physical signs of the one or the rash of the other before pronouncing a positive opinion. With reference to typhoid, it must be borne in mind that its course is less regular in children, and that a high temperature is more common at the outset than in adults. Considering the frequency of diarrhoea and typhoid symptoms in pneumonia, it will be seen that the physical signs and the course of the disease are the only positive means of differentiation. A source of error in the physical signs will be mentioned in another connection.

The cerebral symptoms of pneumonia are rarely so intense, so prolonged, so continuous, or so progressive as those of meningitis, although almost every individual symptom of the one may be present in the other.

I have several times mistaken the invasion of a simple tonsillitis for a commencing pneumonia. This error is likely only in those cases where the severe general symptoms are out of all proportion to the local throat changes, and precede them by a day or two. It is often hard to convince one's self that the patient has nothing more grave than a simple sore throat. This is especially common when the disease prevails as a sort of epidemic, as it does every now and then.

I have mentioned pulmonary congestion as one of the conditions with which pneumonia may be confounded. The following case may serve to make my meaning clear.

I saw, in October last, a girl, seven years of age, with a temperature of $104\frac{3}{4}^{\circ}$, respiration 55, pulse 150. She had been sick a week; mode of invasion not accurately determined. There had been headache, cough, and continuous fever, but no special diarrhœa, no epistaxis. She had been in bed most of the time. There was no characteristic eruption. Examination of the lungs gave evidence only of slight bronchitis. Typhoid was diagnosed, though with some hesitation. The next day the lungs were again examined, and high in the left axilla bronchial breathing and bronchophony were present, and so distinct as to be undoubted. There was no special dulness. I said to a medical friend, "My case of typhoid fever has turned out to be an apex pneumonia." On the following day, greatly to my surprise, the signs at the left apex had entirely disappeared. Further examination revealed the fact of distinct bronchial breathing and voice, and slight dulness over an area half the size of my hand at the right base behind. These signs were not present the day before. I said to my friend, "I was deceived regarding the diagnosis in that case, it

is pneumonia, not, however, in the left apex, but at the right base. The signs to-day are unmistakable."

At an examination made the next day I was again compelled to retract, as the signs at the right base had vanished completely. I returned to my original diagnosis of typhoid, which the subsequent course of the disease proved unquestionably to be the correct one. No further signs of lung consolidation appeared.

I could multiply illustrations of this point. These congestions, sometimes affecting a whole lung, sometimes the base, sometimes the apex, I have seen under many circumstances, most often with malarial fever. Occurring in the course of pneumonia they lead to the belief in a sudden extension of the disease. In one case the signs of consolidation had been limited to the left upper lobe in front and the extreme apex behind. On the day before the crisis they were present over the whole left lung posteriorly. The general symptoms were so much worse I thought there could be no doubt of an extension of the disease. However, as the temperature fell the next day they all disappeared, leaving the signs exactly as they had been two days before.

This subject is one of exceeding interest to me; I wish I could dwell upon it more at length. I hope in the discussion which follows some one may throw additional light upon these obscure cases. I think it is impossible by any physical signs to differentiate between congestion and lung consolidation. Congestion is only recognized by its inconstancy, its mobility, and its evanescent character, rarely lasting more than a couple of days.

The onset of malarial fever and pneumonia are very similar; both usually begin abruptly with vomiting, convulsions, or a chill; in both we have the sudden rise of temperature to from 103° to 105° . When pulmonary congestion is associated with malaria we get the same accelerated breathing as in pneumonia; and it may be even more rapid than in the latter disease. I have in several cases seen it one hundred a minute. In this condition all the

physical signs of commencing pneumonia may also be present. A differential diagnosis in these cases is absolutely impossible at the first examination. Observation of the patient for a day or two, especially noting the temperature curve, usually clears up the case beyond all doubt. In malaria there is almost invariably a marked morning remission. If the lungs are examined then, the physical signs will be found in many cases to have vanished completely, or at least to be insignificant. There is one symptom which has in several cases saved me from unreserved diagnosis of pneumonia in these malarial cases. This is the amount of general prostration; it is almost never so marked as in pneumonia.

The differential diagnosis from broncho-pneumonia will be considered under the latter disease.

BRONCHO-PNEUMONIA.

By this term I understand an inflammation which affects the mucous membrane and the walls of the bronchi, the air-cells, and the interstitial tissue of the lung. The bronchial element predominates, in fact forms the characteristic feature.

Dr. Francis Delafield mentions ("Pathological Studies," 1883) certain anatomical peculiarities of the child's lung which in part account for this. He says, "the bronchi occupy relatively a larger portion of the whole organ; the interstitial tissue is present in larger amount; the cavities of the air-cells are smaller and their walls thicker."

All the latest writers upon the pathology of this disease agree that we can no longer draw the line between broncho-pneumonia and that condition formerly described as capillary bronchitis. The terms are used synonymously. This form is spoken of as generalized, diffuse, or disseminated pneumonia.

Without going fully into a description of the lesions of this disease they may be summarized briefly as follows: 1, Inflammation of the mucous membrane of the bronchi of all sizes; 2, infiltration of their walls with inflamma-

tory products ; 3, acute dilatation of the small bronchi from these changes ; 4, zones of hepatization and congestion surrounding the bronchi ; 5, collapse of groups of air-cells from bronchial obstruction ; 6, extensive congestion of areas neither collapsed nor hepatized ; 7, more or less diffused areas of hepatization ; 8, exudation of fibrine on the pleura ; 9, infiltration of the bronchial glands.

In addition, it is necessary to remember certain conditions affecting the organs of respiration and circulation in children, which do not obtain in adults. The right ventricle of the heart is at birth as thick as the left. Throughout childhood it is relatively much more powerful than in adult life. Hence, it is better able to perform the increased work thrown upon it, by the obstruction to the pulmonary circulation in pneumonia. In this respect the child has a decided advantage over the adult.

Precisely the opposite is true with reference to the respiration. A healthy child produces, according to its body weight, about twice as much carbonic acid as an adult. The pneumonia renders a certain portion of the lungs practically useless for the time, while the febrile process increases the production of carbonic acid, far beyond the quantity in health. Hence, although the child needs more breathing space it actually has much less. Again, the respiratory muscles are not so well developed in early life, and these are weakened by the disease itself. Furthermore, a great amount of the muscular force exerted is lost, because of the yielding chest-walls and the great bronchial obstruction. The latter is due, not only to swelling and the accumulation of secretions, but also to spasm, which plays no unimportant part in a large number of cases. With each inspiration the bronchial secretions are drawn further and further toward the alveoli. The expiratory force being stronger than the inspiratory, more and more air is forced from the air-cells, until they collapse in great numbers, and the chest muscles become exhausted by vainly trying to lift its walls against the atmospheric pressure.

From the facts I fully agree with the conclusion reached by Baginsky, "Pneumonia und Pleuritis," p. 42, that while adults die in pneumonia mainly from heart failure, in children it is the failure of the respiration. This point has, I think, an important practical bearing.

The sexes in broncho-pneumonia are about equally affected, possibly there is a slight predominance of females.

Of fifty-three cases it was presumably primary in seventeen, or about one-third. In ten it complicated whooping-cough; in nine, measles; in nine it followed a primary bronchitis; in the remainder it was secondary to cholera infantum, scarlatina, vaccinia, or malaria, dentition co-existing in several instances.

Only some of the cases were over three years of age. Both lungs were almost invariably involved, although generally to a different degree. The disease is always more intense behind than in front.

The clinical picture presented by broncho-pneumonia is a decided contrast to the lobar form in most of the prominent features. It is nearly always secondary; attacks children debilitated by previous disease; its onset is gradual; it rarely terminates by a crisis, and has no typical course. When it supervenes upon an attack of bronchitis it may be so gradually that it is difficult to tell exactly when the extension took place.

The temperature curve is an exceedingly variable one. It is not so uniformly high as in lobar pneumonia. The diurnal variations are usually greater. The most common course is for it to run from 101° or 102° in the morning to 103° or $104\frac{1}{2}^{\circ}$ in the evening for about ten days, when it subsides gradually, being a week or ten days more before it finally remains normal. Very often the duration of the febrile stage is four weeks instead of three.

In one-fourth of my cases it reached 105° or over. In three it was $106\frac{2}{5}^{\circ}$; one of these cases recovered.

While in general it is true that the disease is dangerous in proportion to the height of the temperature, yet I

have seen death occur as early as the tenth day where the temperature was only once above 101° .

The respirations are always much accelerated. They are more rapid and more labored than in lobar pneumonia. They usually range from sixty to eighty per minute. In severe cases their number rises to ninety, one hundred, or even one hundred and twenty, as I saw in one case.

Let any one try to breathe even eighty times a minute for a few minutes, and he will understand why these children become exhausted.

The pulse generally rises with the temperature and the respirations ; it reaches one hundred and fifty to one hundred and eighty. I have several times seen it two hundred and over.

The amount of general prostration is not so great at first, perhaps, as in lobar pneumonia ; but as the disease progresses it becomes extreme. The children lie preferably upon the back, often too weak or too apathetic to make any resistance to examination. The cough is nearly always distressing. But I know of few things more painful to witness than a child exhausted with pneumonia struggling with a paroxysm of whooping-cough when this complication exists. It seems as though every seizure would be the last.

Toward the close of the disease the drowsiness is much increased, probably from carbonic-acid poisoning ; true coma rarely is present. Other patients continue in a state of extreme nervous irritability, tossing from side to side in great distress, making violent but ineffectual efforts to get more air into the lungs. Sometimes convulsions develop ; these usually end the scene.

The face is quite characteristic ; it is pale and indicative of suffering and anxiety. The *alæ nasi* dilate with each inspiration. Later the lips become livid, and the face slightly cyanotic.

The cry is short, and usually feeble and whining.

The disappearance of the cough is always a bad symp-

tom, and is an indication of general blunting of sensibility from the blood-poisoning.

Death usually occurs during the acute stage from asphyxia and exhaustion, the heart failing after the respiration.

Physical signs.—In all cases of thoracic disease in infants and young children we encounter difficulties not met with in the adult. These are partly incidental, depending on the irritability of the child and its resistance to the examination, and partly inherent, from the fact that the child cannot give us assistance by regulating at will the frequency and the depth of the respiration, and also that the voice sounds are but imperfectly replaced by the cry. The very rapidity of the respiration itself becomes a source of embarrassment.

Palpation.—The information afforded by this sign is not of great value. The thin chest-walls allow the transmission of all vibrations with distinctness, whether they are nasal, laryngeal, tracheal, or bronchial in their origin. When this fremitus is felt all over the chest it signifies little; when exaggerated in areas distinctly circumscribed, it has the same value as in the adult.

Percussion.—Can only give positive information when the lobules hepatized are numerous and close together. When a large part of a lobe is involved, we get dulness which may be as marked as in lobar pneumonia. When the patches are smaller and scattered, which is more frequently the case, the dulness is slight. In those cases where the pneumonia is generalized, involving a large part of both lungs to the same degree, the whole chest may be extra-resonant. The emphysema which always exists about the patches of consolidation, modifies the percussion note behind, and produces the exaggerated resonance almost invariably present in front and over the apices. It is upon *auscultation*, then, that we must mainly rely in the diagnosis of this disease.

The sibilant r  le is usually the first sign in the general-

ized or "suffocative" cases. It then develops very rapidly and may be heard over nearly the whole of both lungs. Vesicular breathing may be almost absent from the obstruction in the bronchi. These râles, when thus generalized, are replaced in a day or two by mucous clicks and moist râles of all sizes equally diffused. These may be the only signs during life.

The respiratory murmur in some cases is simply very much exaggerated or ultra-*puerile*, so that the breathing usually heard in front and at the apex is heard all over the chest. This is especially in cases where the breathing is very rapid. It may vary from this, through all the degrees, vesiculo-bronchial and broncho-vesicular, to pure bronchial breathing. Absence of vesicular breathing does not always mean hepaticization. It may be due to great obstruction in the bronchi with collapse of the air-cells, or to congestion. Pure bronchial breathing, such as is heard in lobar pneumonia, does not usually exist. When it does it is combined with the other signs, marked dullness and increased resonance of the cry, which are found in that disease.

Usually we have a commingling of pulmonary and bronchial sounds, and either element may predominate. The breathing, in most cases, is only broncho-vesicular, high-pitched, particularly the expiration, which is prolonged. Sometimes the râles may completely obscure the breathing sounds. The pitch of the râles thus gives valuable information. When consolidation exists this is high, and they have a sharp, metallic character. The exaggerated resonance of the cry is also valuable here. Auscultation during, or immediately after a paroxysm of coughing, may serve to disclose signs of consolidation not otherwise perceived. As râles over the upper lobes are generally less abundant, changes in respiration here are more easily made out.

Where the pneumonia supervenes upon a bronchitis it is impossible to tell precisely by the physical signs when this extension occurs. Signs of consolidation rarely ap-

pear before the third day, and often not until the seventh or eighth.

When a consolidated area exists in one lung the transmission of the sounds to the opposite side may be so distinct as to lead to the supposition of disease there. Percussion usually enables us to correct this mistake. A more common source of error is that, when the breathing is very rapid, and consequently very superficial, laryngeal and tracheal sounds, and those produced in the primary bronchi, are transmitted and audible over the whole chest, but are particularly loud in the interscapular regions. Here they closely resemble bronchial breathing from consolidation. The fact that the same thing is heard upon both sides, and that there is no dulness, usually suffices to distinguish it from the latter condition. In all cases the signs vary greatly from day to day, changing with the depth of the respiration, the position of the child, etc. Repeated examinations are always necessary before pronouncing positively in regard to the condition of the lungs.

How does broncho-pneumonia terminate?—Of the fatal cases the vast majority die during the acute stage. Of those who survive this period by far the greater number resolve in from three to four weeks. Resolution is more rapid in those cases of disseminated pneumonia than where consolidated areas of considerable extent have formed. In these it is necessarily much slower than in lobar pneumonia, where the inflammatory products are wholly or chiefly within the alveoli and the bronchi.

The most interesting question is: What becomes of those cases (by no means few in number) which at the end of six weeks or two months have shown little or no tendency to resolve, the physical signs remaining as they were during the height of the disease? Three answers may be given:

1. They may become tubercular.
2. They may terminate in chronic fibroid induration.
3. They may recover perfectly.

First, then, in regard to *tuberculosis*. Is it common for a simple broncho-pneumonia to result in cheesy degeneration of the inflammatory products and the patient die of tuberculosis? I have not yet met with a single case which from the clinical history would justify such a diagnosis. Rilliet and Barthez, who are the authors of probably the best article upon the pneumonia of children in any language, state, in their last edition, that this never occurs. That if cheesy degeneration exist, the process must have been tubercular from the outset. Most authorities are not willing at present to go quite so far as this, but admit its possibility where the patient has a strong predisposition to tuberculosis.

We may, I think, safely take the ground that a case of unresolved broncho-pneumonia is extremely unlikely to develop tuberculosis, if there has been beforehand no sufficient grounds for believing the patient to be tubercular.

Secondly, fibroid induration.—Reverting to the pathology of the disease we find that there is in all cases more or less involvement of the fibrous walls of the bronchi, and the interstitial tissue of the lung. The greater the duration of the disease the more marked these changes are. The acute process may pass into a chronic one, with the production of new connective tissue. This may go on until a whole lobe or even a whole lung is converted into almost a solid mass of fibrous tissue, with obliteration of the air-cells, more or less complete dilatation of the bronchi, and thickening of the pleura. Such a lung is, of course, hopelessly crippled. This condition is generally the result of repeated attacks of acute inflammation, or of exacerbations of a chronic process. These patients suffer more or less from pulmonary symptoms, and frequently die in some of these exacerbations, or they may live on indefinitely.

Thirdly, complete recovery.—I know it is necessary nowadays, in speaking of recovery, to define exactly what is meant by it. I use the word in a clinical sense,

not in an anatomical one. By recovery in the class of cases we are considering, I understand a condition in which the lung performs its functions normally, so far as we can judge from the patient's symptoms, and when the ordinary methods of physical examination fail to detect any material alteration of the signs present in health.

That it is possible for a lung in which consolidation from broncho-pneumonia has existed for several months to return to a condition in which no changes would be apparent under the microscope, I doubt very much. Using the term in the sense defined, I believe that the greater number of these cases ultimately recover perfectly. All branches of pathology illustrate the wonderful reparative powers of nature in young children. This is strikingly shown in diseases of bone. The lungs form no exception to this rule. Lung consolidations, which in adults would seem hopeless, are disposed of in the most surprising manner by nature in young children. I have followed many of these cases for two years and more, and have been astonished beyond measure in some of them to find how completely the disease had cleared up, sometimes under circumstances, too, anything but favorable. I have come to expect this result when the patient has not a strong tubercular predisposition, or when the surroundings were not hopelessly bad.

There are some special conditions which may always be expected to delay resolution. This is particularly true of whooping-cough. It seems well-nigh impossible for the lungs to clear up while whooping-cough continues.

Yet I have learned never to despair of these cases. The dangers are very great during the acute stage of the pneumonia, half of my cases died. If, however, the child does withstand the dangers of this period, I expect him to recover, except under the conditions just stated, although resolution may be delayed for many months. I cannot forbear mentioning a few cases under this head.

A boy, aged two and one-half years, came under observa-

tion in July, 1882, with whooping-cough. He developed an acute broncho-pneumonia, in the left lung chiefly. The lower lobe posteriorly became almost completely consolidated, and there were small patches of consolidation above. Then the right lung became involved, and the middle and lower lobes behind almost solid. After three or four weeks his fever gradually subsided, but his whooping-cough continued, and the lungs showed no disposition to clear up. He became much wasted, exceedingly anæmic, and the case seemed hopeless. Another physician, a well-recognized authority, saw the case with me. He concurred in the opinion I had already formed that the process in the lungs was tubercular, and the prognosis absolutely bad. The case passed from under my care, but I had an opportunity to examine the patient six months later. I found that the right lung had almost entirely resolved, while as yet but little change had taken place in the left.

One year from his attack I saw him again, there was good respiratory murmur over both lungs, a little higher pitched on the left side than the right, with slight dulness here, a few fine râles, and some old pleuritic friction. His general condition was excellent, he had grown plump and hearty. I have examined him at intervals of a few months since that time, and have noted a gradual disappearance of the abnormal signs. I saw him this present month, two and one-half years after his attack, and on a very thorough examination the only thing I could detect was an occasional coarse râle over the left base. There was no retraction of the chest, no dulness, the respiratory and voice sounds were normal. Nothing, in fact, existed to lead one to suppose that the lungs had ever been the seat of serious disease.

Another case, fifteen months old, had first whooping-cough, then acute broncho-pneumonia; after this had existed a week he came down with measles, which was farther complicated by thrush and a very obstinate diarrhoea. An extension of the pneumonia took place with

the measles. There was consolidation at the left apex and in the right middle lobe behind and in the axillary region, with pretty generally diffused pneumonia along the posterior borders of both lungs. Despite all these complications, and extremely unfavorable hygienic surroundings, he disappointed us all by surviving. His fever, which was high at the outset, gradually wore away, and after a couple of months subsided altogether, and his lungs began slowly to clear up, and he made a good recovery. He was seen eighteen months afterward, and had grown to a stout, healthy boy, showing no signs of his previous disease.

But one more case: A boy, aged three years, came under my care in September, 1884, with whooping-cough which had already lasted six weeks, and for two weeks had been very severe. He developed acute bronchopneumonia, involving the base of the left lung behind. As the acute febrile symptoms were subsiding an exacerbation took place, and a large part of the middle and lower lobes of the right side were invaded, with an extension of the disease in the left lung. The temperature had fallen nearly to the normal again, and the case began to look a little more promising, when I was called, October 28th, to find him with a temperature of 103° . The next day it rose to 105° , and a profuse eruption came out over the body, which a typical desquamation, beginning ten days later, proved to be scarlet fever. This was borne quite as well as could have been expected, and brought no new complication except that the consolidation in the lungs became a little more extensive and more complete. During desquamation a crop of furuncles appeared over the trunk, face, and extremities. This was only a side issue, and was disposed of in a few days. I should not omit to state that during all this time his whooping-cough continued. By means of chloral and belladonna it was much modified, but the minimum reached was eight or ten severe paroxysms a day. After the furunculosis he began slowly to gain in

flesh, had very little fever, and in a few weeks was able to get about.

I examined him on December 19th, and found signs of complete consolidation over the whole of the left lower lobe, and almost complete over the greater part of the middle and lower lobes of the right side posteriorly. These signs were almost identical with those recorded early in October. His whooping-cough, however, had almost subsided.

At the next examination, made two weeks later, I was astonished to find that the right lung had almost entirely resolved. Upon the left side the dulness was very slight. The breathing over the lower lobe was broncho-vesicular, with moist râles, while before it had been pure bronchial with no râles, and the dulness had been complete. He is still under treatment, but in excellent condition, and bids fair to make as good a recovery as the first case related.¹

The mortality in acute broncho-pneumonia is very high under all circumstances, and contrasts strongly with lobar pneumonia in children. The death-rate in my cases was forty per cent. ; of the cases in which the disease was secondary, forty-six per cent. ; of those presumably primary, twenty-nine per cent. died. These figures accord pretty well with those given by others. All agree that the prognosis is worst where the pneumonia complicates whooping-cough. Ziemssen gives the mortality of these cases as fifty per cent. Occurring with measles it depends much upon the character of the epidemic. Ziemssen gives thirty-three per cent. as the average death-rate. The younger the child, other things being equal, the worse the prognosis. It is also worse where any constitutional taint exists, such as syphilis, scrofula, or tuberculosis. Rickets introduces two elements of danger—the interference with respiration from mechanical causes depending upon deformity of the chest, and the en-

¹ An examination February 16th, showed almost complete disappearance of all these signs.

feeble, flabby condition of the muscles, which are almost as characteristic of this disease as is the bone softening.

Of the special symptoms which indicate an unfavorable termination, should be mentioned a persistent high temperature, a pulse not only rapid but small and thready, cessation of the cough, convulsions late in the disease, an abundant diarrhœa, drying up of the secretions of the mouth, nose, or eyes, steady emaciation, great irritability, or the reverse, marked drowsiness, and slight cyanosis; but more than any other single symptom, the character of the respiration. Of sixteen cases in which the number of respirations reached eighty a minute, eleven proved fatal; of six cases in which it was ninety or over, all died. Yet it is not always the rapidity of the respirations which is our best guide. Although not rapid, they may be feeble, jerking, superficial, or irregular, all of these characteristics being unfavorable.

Diagnosis.—Is it possible to make a diagnosis between lobar and broncho-pneumonia, and, if possible, is this of any practical value? I answer both these questions in the affirmative. In the matter of prognosis it is of very great importance, as the figures above cited show. In the vast majority of cases, the two diseases can be distinguished by the symptoms and physical signs.

The following are some of the most striking points of contrast. Under one year old, the chances are greatly in favor of broncho-pneumonia. Lobar, like the disease in adults, is much more prevalent in the spring months, while broncho-pneumonia, in so far as it is influenced by season at all, is quite as common late in fall and winter as in the spring.

Lobar pneumonia is usually primary, occurs most often in stout, robust children, and the onset is sudden and violent. Broncho-pneumonia is usually secondary, follows all debilitating influences, and is more often developed gradually or insidiously. Lobar pneumonia is usually limited to one lobe, often only a portion of a lobe, the area is sharply defined, the rest of this lung

and the opposite lung being usually free. Broncho-pneumonia almost invariably affects both sides, and may be diffused through nearly the whole of both lungs; when consolidated areas exist they shade off gradually into the surrounding parts, and are irregularly scattered through the lung.

Râles in lobar pneumonia belong to the early stage, and then usually disappear till resolution commences; consolidation comes early. In broncho-pneumonia the signs of consolidation are always preceded for some days by those of capillary bronchitis. Consolidation comes later, or may not come at all. When present its signs are almost never pure, but bronchial signs are mingled with them, heard at its margins, and in the other lung. The persistence of the subcrepitant râle throughout the disease is almost of itself conclusive proof of broncho-pneumonia. If the pneumonia is primary and at the apex only, it can be pronounced lobar without hesitation.

In doubtful cases the mode of termination generally settles the question, being critical in lobar, gradual in broncho-pneumonia.

The diagnosis between broncho-pneumonia and tuberculosis is always a matter of great difficulty and attended with more or less uncertainty. The persistence of an afternoon fever, the more rapid progress of the disease, the greater emaciation, and a distinct tubercular family history—all point to this latter disease in the lungs. Symptoms of tubercular disease in the glands, bones, intestines, or brain, coexisting, increase this probability. In a large number of cases the question can only be decided in the dead-house.

Treatment.—I have not much faith in drugs in the management of pneumonia in children. I have tried most of those usually recommended very extensively, and am able to speak quite positively of what they do *not* do. Quinine and the other cinchona alkaloids, I believe, have little effect in aborting the disease, shortening its course, or in reducing the temperature. I have tried them in

early and late stages, in small and in large doses, and, except in those cases in which there was an undoubted malarial complication, I have found them totally without benefit. Very large doses, such as twenty or thirty grains of quinine to a young child, I believe to be positively injurious, if not dangerous. It frequently upsets the stomach, is always difficult to administer, and renders more difficult the administration of necessary nourishment and stimulants. I feel sure that my cases have done better since I left off its use altogether, except as when indicated above.

Aconite in the very beginning of lobar pneumonia I have used considerably in very small frequent doses. Patients are usually rendered more comfortable by its use, and it adds no disturbing element; but that it essentially modifies the intensity or the duration of the disease I am very doubtful. I have seen enough benefit from it to encourage me to continue in its use.

The use of emetics in broncho-pneumonia when the dyspnoea is very great, the face slightly cyanotic, the extremities cold, and the tubes filled with mucus, as shown by large and small moist râles over the whole chest, I have tried in a number of cases. I cannot now remember a single instance in which any decided benefit followed; in several I am sure it hastened death. Ipecac was the emetic used. With local revulsive measures, which I will presently describe, and the free use of stimulants, I have been much more successful.

The treatment I have finally settled upon can be briefly summarized in a few words: *nourishment, opium, alcohol, local applications.*

If the child be at the breast it should be kept there, care being taken that it be not nursed too frequently. Of this there is danger from the great thirst which accompanies the fever; this may be allayed by water in which the stimulants are given. In older children a milk diet as in other acute diseases.

Opium I believe to be worth more in acute pneumonia

than all other drugs combined. It quiets the restlessness, relieves the pain and the cough, and, perhaps more important than all, sustains the nervous system under the strain which the disease produces, and in this way seems to exercise a beneficial effect upon the inflammatory process. I have found the tablet triturates of morphia, $\frac{1}{50}$ grain, a very eligible preparation; one may be given every two or three hours to a child a year old. Of late I have used a great deal, and have come to prefer the tincture of opium and ipecac, or the liquid Dover's powder to any other preparation of opium; it may be given in drop doses at the same intervals.

Alcoholic stimulants in a large number of cases of lobar pneumonia are never needed. In broncho-pneumonia they are often required from the outset. They should be given fearlessly, but of course intelligently. I have never regretted giving too much, but have often regretted beginning the larger doses too late. It is a mistake to suppose that children do not bear alcoholic stimulants well. The quantity must be regulated by the character of the pulse, the breathing, but most of all by the general aspect of the patient. From one to two ounces of brandy in twenty-four hours is the quantity I have generally given to a child a year old; double the amount for one two to three years old. In very bad cases it may be necessary to go much beyond these quantities, up to six ounces a day, or even more.

Local applications.—For the average case the following will be found to serve a very good purpose: next to the skin is placed a layer of cotton wadding an inch thick, enveloping the whole chest; over this is placed a tightly-fitting oiled-silk shirt, to which the cotton is sewed to prevent its slipping. This protects the chest against any atmospheric changes, and keeps it at a uniform temperature. When once applied it need not be changed for a week; the patient is not disturbed by the necessity of frequent renewal. Poultices, unless very carefully, intelligently, and conscientiously applied, are capable of do-

ing quite as much harm as good. Cold poultices, poultices that have slipped from their places and lain for hours, perhaps, over the loins or over the epigastrium, who has not seen them? The exposure and disturbance of the patient which the frequent renewal of a poultice requires are decided objections. Yet, after all has been said, they are still, I firmly believe, when properly used, the most efficient means we possess in the severe cases, especially where the disease is diffuse or generalized. Their efficiency is much increased by the addition of mustard. In the condition above described, in speaking of emetics, where both lungs are in a state of intense engorgement and the heart is failing, much better results than by emetics may be obtained by putting the child in a mustard bath up to its hips until the skin is reddened thoroughly, the application of a mustard poultice large enough to envelop the whole chest, and the internal administration of brandy in teaspoonful doses every twenty or thirty minutes. I have had the satisfaction of seeing several very bad cases saved, I think, by this treatment. One, a little girl of eight months, in which the temperature was 106.4° , the respiration 80, and the pulse 200.

Bearing in mind the fact that in broncho-pneumonia it is the respiratory function which first fails—this being followed by collapse and congestion—we should use every means in our power to sustain respiration and to remove every possible source of embarrassment. Friction of the chest, daily, with some mild counter-irritant, may be used in conjunction with the oil-silk and cotton. Every means possible should be employed to keep up a good peripheral circulation and to prevent congestion of the unaffected lung, which is so often the immediate cause of death. The child should not be allowed to lie too long in one position.

Carbonate of ammonia is very often of decided benefit both as a respiratory and a heart stimulant. It is best given frequently and in small doses. The use of oxygen inhalations I have never had an opportunity of trying

when they seemed indicated. Many are loud in their praise, and it seems as though we might expect much from their use.

In one case of lobar pneumonia strikingly beneficial results were obtained from the use of the cold pack. The patient was a stout boy of two years, and the only part of the lung affected was the extreme right apex. After being above 105° for five days the temperature rose on the eighth day of the disease to $106\frac{3}{4}^{\circ}$. The patient lay quietly, but was not stupid, with very great prostration. The pulse was 180 and weak. He was put first in a mustard bath for fifteen minutes without any apparent effect and then in a cold pack which was kept up eight hours. The temperature gradually came down to $103\frac{1}{2}^{\circ}$ and did not again go above that point, though the crisis did not occur for three days.

In broncho-pneumonia, where the temperature was very high, other conditions have always been present, like intense pulmonary congestion and cyanosis, which made me afraid to use cold applications in any form.

To promote resolution in broncho-pneumonia in addition to the usual internal remedies employed, cod-liver oil, iron, etc., I have been in the habit of keeping up a mild counter-irritation over the chest by iodine or friction with some stimulating liniment.

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